



- Notes :
1. Answer **three** question from Section A and **three** question from Section B.
 2. Assume suitable data wherever necessary.
 3. Illustrate your answer necessary with the help of neat sketches.
 4. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) What is meant by rigid body displacement? Explain in short. **3**
b) Differentiate between isotropic and orthotropic materials. **4**
c) Derive the stress equilibrium equation for a three dimensional stress system subjected to body forces in X, Y & Z direction. **7**
2. a) What is Airy's stress function? Derive the expression. **13**
$$\frac{\partial^4 \phi}{\partial x^4} + 2 \frac{\partial^4 \phi}{\partial x^2 \partial y^2} + \frac{\partial^4 \phi}{\partial y^4} = 0$$
3. At a point P in an elastic body the state of stress is given by. **13**
$$b_{ij} \begin{bmatrix} 15 & -7 & +4 \\ -7 & 12 & 6 \\ +4 & 6 & 8 \end{bmatrix}$$

Find the value of the principal stress and direction.
4. Derive the equation of deflection curve of a beam of narrow rectangular cross section of unit width simply supported at end carrying UDL of intensity 'q' on the entire span. **13**
5. a) Derive expression for torsion of elliptical cross section bar. **8**
b) Explain St. Venant's principle. **5**

SECTION - B

6. Explain the following.
a) Inelastic column behaviour. **7**
b) Imperfect columns. **6**
7. Derive the expression for differential equation for lateral buckling of a beam. **13**
8. a) Explain stable, unstable and neutral equilibrium with suitable example. **5**
b) Derive the expression for critical load for a column fixed at both ends by energy method. **8**
9. Explain Galerkin method to find the critical load that one end fixed and other free consider **13**
$$y = A(x^3 - 3x^3L + 2x^4).$$
10. Evaluate the expression for strain energy due to Saint Venant and warping torsion combination. **13**
